

# New Hampshire Volunteer Lake Assessment Program

## 2003 Interim Report for Maxwell Pond Manchester



NHDES  
Water Division  
Watershed Management Bureau  
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# OBSERVATIONS & RECOMMENDATIONS

After reviewing data collected from **MAXWELL POND, MANCHESTER**, the program coordinators have made the following observations and recommendations:

Thank you for your continued hard work sampling the pond this season! Your monitoring group sampled **four** times this season and has done so for many years! As you know, with multiple sampling events each season, we will be able to more accurately detect changes in water quality. Keep up the good work!

**Thank you for carrying out one of your most important responsibilities as a volunteer monitor; educating your association, community, and city officials about the quality of your pond and what can be done to protect it!**

## FIGURE INTERPRETATION

- **Figure 1 and Table 1:** The graphs in Figure 1 (Appendix A) show the historical and current year chlorophyll-a concentration in the water column. Table 1 (Appendix B) lists the maximum, minimum, and mean concentration for each sampling season that the pond has been monitored through the program.

Chlorophyll-a, a pigment naturally found in plants, is an indicator of the algal abundance. Because algae are usually microscopic plants that contain chlorophyll-a, and are naturally found in lake ecosystems, the chlorophyll-a concentration measured in the water gives an estimation of the algal concentration or lake productivity. **The mean (average) summer chlorophyll-a concentration for New Hampshire's lakes and ponds is 7.02 ug/L.**

The current year data (the top graph) show that the chlorophyll-a concentration **remained stable** from May to July, and then **increased** in October. The chlorophyll-a concentration in all four months was **less than** the state mean.

The historical data (the bottom graph) show that the 2003 chlorophyll-a mean is **less than** the state mean.

While algae are naturally present in all lakes/ponds, an excessive or increasing amount of any type is not welcomed. In freshwater lakes/ponds, phosphorus is the nutrient that algae depend upon for growth. Algal concentrations may increase with an increase in nonpoint sources of phosphorus loading from the watershed, or in-lake sources of phosphorus loading (such as phosphorus releases from the sediments). Therefore, it is extremely important for volunteer monitors to continually educate residents about how activities within the watershed can affect phosphorus loading and pond quality.

- **Figure 2 and Table 3:** The graphs in Figure 2 (Appendix A) show historical and current year data for pond transparency. Table 3 (Appendix B) lists the maximum, minimum and mean transparency data for each sampling season that the pond has been monitored through the program.

Volunteer monitors use the Secchi-disk, a 20 cm disk with alternating black and white quadrants, to measure water clarity (how far a person can see into the water). Transparency, a measure of water clarity, can be affected by the amount of algae and sediment from erosion, as well as the natural colors of the water. **The mean (average) summer transparency for New Hampshire's lakes and ponds is 3.7 meters.**

The current year data (the top graph) show that the in-lake transparency **remained stable** from June to July, and October. The transparency in June, July, and October was **less than** the state mean.

The historical data (the bottom graph) show that the 2003 mean transparency is **less than** the state mean.

Overall, the statistical analysis of the historical data show that the mean annual in-lake transparency has **remained stable** since monitoring began in 2000.

Typically, high intensity rainfall causes erosion of sediments into lakes/ponds and streams, thus decreasing clarity. Efforts should continually be made to stabilize stream banks, pond shorelines, disturbed soils within the watershed, and especially dirt roads located immediately adjacent to the edge of tributaries and the pond. Guides to Best Management Practices designed to reduce, and possibly even

eliminate, nonpoint source pollutants, such as sediment loading, are available from DES upon request.

- **Figure 3 and Table 8:** The graphs in Figure 3 (Appendix A) show the amounts of phosphorus in the epilimnion (the upper layer) and the hypolimnion (the lower layer); the inset graphs show current year data. Table 8 (Appendix B) lists the annual maximum, minimum, and median concentration for each deep spot layer and each tributary since the pond has joined the program.

Phosphorus is the limiting nutrient for plant and algae growth in New Hampshire's freshwater lakes and ponds. Too much phosphorus in a pond can lead to increases in plant and algal growth over time. **The median summer total phosphorus concentration in the epilimnion (upper layer) of New Hampshire's lakes and ponds is 11 ug/L. The median summer phosphorus concentration in the hypolimnion (lower layer) is 14 ug/L.**

The current year data for the epilimnion (the top inset graph) show that the phosphorus concentration **increased** from May to June and then **remained stable** from July to October. The phosphorus concentration in all four months was **greater than** the state median.

The historical data show that the 2003 mean epilimnetic phosphorus concentration is **greater than** the state median.

One of the most important approaches to reducing phosphorus loading to a waterbody is to continually educate watershed residents about its sources and how excessive amounts can adversely impact the ecology and value of lakes and ponds. Phosphorus sources within a lake or pond's watershed typically include septic systems, animal waste, lawn fertilizer, road and construction erosion, and natural wetlands.

#### **TABLE INTERPRETATION**

Phytoplankton populations undergo a natural succession during the growing season (Please refer to the "Biological Monitoring Parameters" section of this report for a more detailed explanation regarding seasonal plankton succession). Diatoms and golden-brown algae are typical in New Hampshire's less productive lakes and ponds.

- **Table 2: Phytoplankton**

Table 2 (Appendix B) lists the current and historic phytoplankton species observed in the pond. The dominant phytoplankton species

observed this year were ***Cyclotella*, *Melosira*, *Tabellaria* and *Eunotia*** which are all diatoms.

➤ **Table 4: pH**

Table 4 (Appendix B) presents the in-lake and tributary current year and historical pH data.

pH is measured on a logarithmic scale of 0 (acidic) to 14 (basic). pH is important to the survival and reproduction of fish and other aquatic life. A pH below 5.5 severely limits the growth and reproduction of fish. A pH between 6.5 and 7.0 is ideal for fish. The mean pH value for the epilimnion (upper layer) in New Hampshire's lakes and ponds is **6.5**, which indicates that the surface waters in state are slightly acidic. For a more detailed explanation regarding pH, please refer to the "Chemical Monitoring Parameters" section of this report.

The epilimnion pH at the deep spot this season ranged from **5.97** in to **6.61**, which means that the water is ***slightly acidic***.

Due to the presence of granite bedrock in the state and the deposition of acid rain, there is not much that can be done to effectively increase pond pH.

➤ **Table 5: Acid Neutralizing Capacity**

Table 5 (Appendix B) presents the current year and historic epilimnetic ANC for each year the pond has been monitored through VLAP.

Buffering capacity or ANC describes the ability of a solution to resist changes in pH by neutralizing the acidic input to the lake. The mean ANC value for New Hampshire's lakes and ponds is **6.7 mg/L**, which indicates that many lakes and ponds in the state are "highly sensitive" to acidic inputs. For a more detailed explanation, please refer to the "Chemical Monitoring Parameters" section of this report.

The Acid Neutralizing Capacity (ANC) of the epilimnion (the upper layer) continues to remain ***approximately equal to*** the state mean of **6.7 mg/L**. Specifically, the pond is classified by DES as ***highly sensitive*** to acidic inputs (such as acid precipitation).

➤ **Table 6: Conductivity**

Table 6 (Appendix B) presents the current and historic conductivity values for tributaries and in-lake data. Conductivity is the numerical expression of the ability of water to carry an electric current. The

mean conductivity value for New Hampshire's lakes and ponds is **62.1 uMhos/cm**. For a more detailed explanation, please refer to the "Chemical Monitoring Parameters" section of this report.

The conductivity has **increased** in the pond and inlets since monitoring began. In addition, the in-lake conductivity is **greater than** the state mean. Typically, sources of increased conductivity are due to human activity. These activities include septic systems that fail and leak leachate into the groundwater (and eventually into the tributaries and the pond), agricultural runoff, and road runoff (which contains road salt during the spring snow melt). New development in the watershed can alter runoff patterns and expose new soil and bedrock areas, which could contribute to increasing conductivity. In addition, natural sources, such as iron deposits in bedrock, can influence conductivity.

We recommend that your monitoring group continue to conduct stream surveys and storm event sampling along the inlet(s) with elevated conductivity so that we can determine what may be causing the increases.

*For a detailed explanation on how to conduct rain event and stream surveys, please refer to the 2002 VLAP Annual Report "Special Topic Article", or contact the VLAP Coordinator.*

➤ **Table 8: Total Phosphorus**

Table 8 (Appendix B) presents the current year and historic total phosphorus data for in-lake and tributary stations. Phosphorus is the nutrient that limits the algae's ability to grow and reproduce. Please refer to the "Chemical Monitoring Parameters" section of this report for a more detailed explanation.

➤ **Table 9 and Table 10: Dissolved Oxygen and Temperature Data**

Table 9 (Appendix B) shows the dissolved oxygen/temperature profile(s) for the 2003 sampling season. Table 10 (Appendix B) shows the historical and current year dissolved oxygen concentration in the hypolimnion (lower layer). The presence of dissolved oxygen is vital to fish and amphibians in the water column and also to bottom-dwelling organisms. Please refer to the "Chemical Monitoring Parameters" section of this report for a more detailed explanation.

The dissolved oxygen concentration was relatively **high** at all depths sampled at the deep spot of the pond in **May and June**. Typically, shallow lakes and ponds that are not deep enough to stratify into

more than one or two layers will have relatively high amounts of oxygen at all depths. This is due to continual lake mixing and diffusion of oxygen into the bottom waters induced by wind and wave action. However, in **July and October**, dissolved oxygen concentration **decreased** with a **less the 50%** dissolved oxygen saturation recorded at all depths in **October**.

➤ **Table 11: Turbidity**

Table 11 (Appendix B) lists the current year and historic data for in-lake and tributary turbidity. Turbidity in the water is caused by suspended matter, such as clay, silt, and algae. Water clarity is strongly influenced by turbidity. Please refer to the “Other Monitoring Parameters” section of this report for a more detailed explanation.

**DATA QUALITY ASSURANCE AND CONTROL**

**Annual Assessment Audit:**

The DES biologist did not conduct a “Sampling Procedures Assessment Audit” for your monitoring group. Your monitoring group continues to do an **excellent** job collecting samples. Keep up the good work!

Please see the following helpful hints for a few aspects regarding sample collection:

- **Finding the deep spot:** Please remember to locate the deep spot using three reference points from the shoreline. This method is known as **triangulation**. In addition, depth finders and Global Positioning System (GPS) technology may be used to further pinpoint the location of the deep spot. In addition, please remember to check the depth of the deep spot by **sounding** to ensure that you have actually located the deepest spot. To sound the bottom, simply fill the Kemmerer bottle with lake water from the surface and then lower the bottle into the lake until you feel it touch the bottom. When you have reached the bottom, check the depth on the calibrated chain. You may need to move to another location and repeat this procedure a few times until the deepest spot is located. When you have found the deep spot, please remember to write the depth of the field data sheet. **Sounding may disturb the sediment, so please allow the bottom to settle out before collecting the deepest sample.**
- **Anchoring at deep spot:** Please remember to use an anchor with sufficient weight and sufficient amount of rope to prevent the boat from drifting while sampling at the deep spot. It is difficult for the biologist to collect an accurate and representative dissolved oxygen/temperature profile when the boat is drifting. In addition, it is difficult to view the secchi disk and collect samples from the proper

depths when the boat is drifting. Depending on the depth of the pond and the wind conditions, it may be necessary to use two anchors!

- **Hypolimnion (lower layer) sample collection:** Always remember to allow the pond bottom to settle after you sound the bottom before collecting the hypolimnion (lower layer) sample. In addition, please be careful not to hit the pond bottom and make sure that there is no sediment in the Kemmerer bottle before filling the sample bottles. When the pond bottom is disturbed, sediment, which typically contains attached phosphorus, is released into the water column.
- **Secchi disk readings:** When measuring the transparency at the deep spot, please remember to take **at least two** secchi disk readings. Since the depth to which the secchi disk can be seen in the water column can vary depending on how windy or sunny it is, and also on the eyesight of the volunteer monitor, it is best to have at least two people take a reading. In addition, please make sure that the readings are taken on the shady, non-windy side of the boat, between the hours of 10 am and 2 pm.
- **Chlorophyll-a Sampling:** When collecting the chlorophyll-a sample using the **composite method**, please make sure to collect one Kemmerer bottle full of water at each meter from the starting point up to 1 meter from the surface. Specifically, in lakes with one or two thermal layers, begin at 2/3 the total depth and collect water at every meter up to the surface. In lakes with three layers, start at the middle of the middle layer (metalimnion) and collect water at every meter up to the surface.
- **Chlorophyll-a Sampling:** When collecting the chlorophyll-a sample using the **integrated tube method**, please make sure to lower both the weighted end and chain to the appropriate sample depth. Specifically, in lakes with one or two thermal layers, lower the weighted end and chain to 2/3 the total depth. In lakes with three layers, lower the weighted end and the chain to the middle of the middle layer (metalimnion). Crimp the end of the tube tightly and haul the weighted end up *by the chain only*. Lift the *uncrimped* end above your head so the open end is always higher than the water level in the tube to ensure that the sample does not escape out of the top of the tube.
- **Tributary Sampling:** Please do not sample tributaries that are not flowing. Due to the lack of flushing, stagnant water typically contains elevated amounts of chemical and biological constituents that will lead to erroneous results.



- **Tributary Sampling:** Please do not sample tributaries that are too shallow to collect a “clean” sample (i.e.; free from sediment and organic debris). You may need to move upstream or downstream to collect a “clean” sample. If the stream is not deep enough and the bottom sediment is disturbed while sampling, the phosphorus concentration in the sample will likely be elevated.

In addition, please do not sample tributaries if the bottom sediment has been disturbed as this will likely result in an elevated phosphorus concentration. If you disturb the stream bottom while sampling, please rinse out the bottle and move to an upstream location so that you can sample in an undisturbed area.

### **Sample Receipt Checklist**

Each time your monitoring group dropped off samples at the laboratory this summer, the laboratory staff completed a sample receipt checklist to assess and document if the volunteer monitors followed proper sampling techniques when collecting the samples. The purpose of the sample receipt checklist is to minimize, and hopefully eliminate, future re-occurrences of improper sampling techniques.

Overall, the sample receipt checklist showed that your monitoring group did an **excellent** job when collecting samples and submitting them to the laboratory this season! Specifically, the members of your monitoring group followed the proper field sampling procedures and there was no need for the laboratory staff to contact your group with questions, and no samples were rejected for analysis.

Please see the following helpful hints for a few aspects regarding sample quality control:

- **Sample Holding Time:** Please remember to return samples to the laboratory **within 24 hours of sample collection**. This will ensure that samples do not degrade before they are analyzed. If you plan to sample on the weekend, please sample on Sunday, preferably in the afternoon, and return samples to the lab first thing on Monday morning to ensure that samples can be analyzed within 24 hours. ***E.coli* samples that are more than 24 hours old will not be accepted by the laboratory for analysis.**
- **Sample “Cooling”:** Please remember to bring a cooler with ice when you sample. Samples should be put directly into the cooler and kept on ice until they are dropped off at the laboratory. This will ensure that samples do not degrade before they are analyzed. If you plan to sample on the weekend, please sample on Sunday, preferably in the

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afternoon, and return samples to the lab first thing on Monday morning to ensure that samples can be analyzed within 24 hours.

- **Sample Labeling:** Please make sure to label your samples with a waterproof pen (a black sharpie permanent marker works best), preferably before sampling. Make sure that the ink does not wash off the bottle when exposed to water. If your association has made its own sample bottle labels, please make sure to fold over one corner of each label before placing it on a sample bottle so that the label will not become permanently attached to the bottle. In addition, please make sure that the labels will stick to the bottles when they are wet.

### **NOTES**

- **Biologist's Note (10/16/03):** Strong flow due to storm on 10/15/03.

### **USEFUL RESOURCES**

*Acid Deposition Impacting New Hampshire's Ecosystems, ARD-32, NHDES Fact Sheet, (603) 271-3505, or [www.des.state.nh.us/factsheets/ard/ard-32.htm](http://www.des.state.nh.us/factsheets/ard/ard-32.htm).*

*Aquarium Plants and Animals: Don't leave them stranded.* Informational pamphlet sponsored by NH Fish and Game, Aquaculture Education and Research Center, and NHDES (603) 271-3505.

*Best Management Practices to Control Nonpoint Source Pollution: A Guide for Citizens and Town Officials, NHDES-WD 97-8, NHDES Booklet, (603) 271-3503.*

*A Boater's Guide to Cleaner Water, NHDES pamphlet, (603) 271-3503.*

*Camp Road Maintenance Manual: A Guide for Landowners.* Kennebec Soil and Water Conservation District, 1992, (207) 287-3901.

*Comprehensive Shoreland Protection Act, RSA 483-B, WD-SP-5, NHDES Fact Sheet, (603) 271-3503 or [www.des.state.nh.us/factsheets/sp/sp-5.htm](http://www.des.state.nh.us/factsheets/sp/sp-5.htm).*

*Cyanobacteria in New Hampshire Waters Potential Dangers of Blue-Green Algae Blooms, NHDES Fact Sheet, (603) 271-3505, or [www.des.state.nh.us/factsheets/wmb/wmb-10.htm](http://www.des.state.nh.us/factsheets/wmb/wmb-10.htm).*

*Erosion Control for Construction in the Protected Shoreland Buffer Zone, WD-SP-1, NHDES Fact Sheet, (603) 271-3503 or [www.des.state.nh.us/factsheets/sp/sp-1.htm](http://www.des.state.nh.us/factsheets/sp/sp-1.htm)*

*Impacts of Development Upon Stormwater Runoff, WD-WQE-7, NHDES Fact Sheet, (603) 271-3503, or [www.des.state.nh.us/factsheets/wqe/wqe-7.htm](http://www.des.state.nh.us/factsheets/wqe/wqe-7.htm)*

*Iron Bacteria in Surface Water, WD-BB-18, NHDES Fact Sheet, (603) 271-3503 or [www.des.state.nh.us/factsheets/bb/bb-18.htm](http://www.des.state.nh.us/factsheets/bb/bb-18.htm)*

*Is it Safe to Eat the Fish We Catch? Mercury and Other Pollutants in Fish*, NH Department of Health and Human Services pamphlet, 1-800-852-3345, ext. 4664.

*Lake Protection Tips: Some Do's and Don'ts for Maintaining Healthy Lakes*, WD-BB-9, NHDES Fact Sheet, (603) 271-3503 or [www.des.state.nh.us/factsheets/bb/bb-9.htm](http://www.des.state.nh.us/factsheets/bb/bb-9.htm).

*Management of Canada Geese in Suburban Areas: A Guide to the Basics*, Draft Report, NJ Department of Environmental Protection Division of Watershed Management, March 2001, [www.state.nj.us/dep/watershedmgt/DOCS/BMP\\_DOCS/Goosedraft.pdf](http://www.state.nj.us/dep/watershedmgt/DOCS/BMP_DOCS/Goosedraft.pdf).

*Proper Lawn Care In the Protected Shoreland, The Comprehensive Shoreland Protection Act*, WD-SP-2, NHDES Fact Sheet, (603) 271-3503 or [www.des.state.nh.us/factsheets/sp/sp-2.htm](http://www.des.state.nh.us/factsheets/sp/sp-2.htm).

*Road Salt and Water Quality*, WD-WMB-4, NHDES Fact Sheet, (603) 271-3503 or [www.des.state.nh.us/factsheets/wmb/wmb-4.htm](http://www.des.state.nh.us/factsheets/wmb/wmb-4.htm).

*Sand Dumping - Beach Construction*, WD-BB-15, NHDES Fact Sheet, (603) 271-3503 or [www.des.state.nh.us/factsheets/bb/bb-15.htm](http://www.des.state.nh.us/factsheets/bb/bb-15.htm).

*Swimmers Itch*, WD-BB-2, NHDES Fact Sheet, (603) 271-3503 or [www.des.state.nh.us/factsheets/bb/bb-2.htm](http://www.des.state.nh.us/factsheets/bb/bb-2.htm).

*Through the Looking Glass: A Field Guide to Aquatic Plants*. North American Lake Management Society, 1988, (608) 233-2836 or [www.nalms.org](http://www.nalms.org).

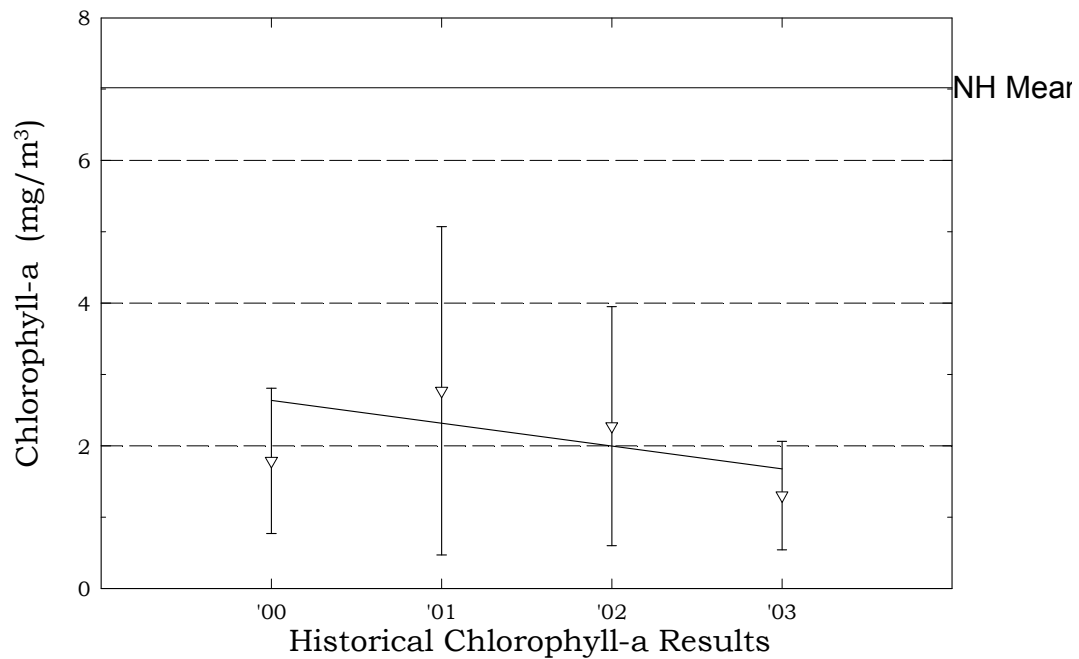
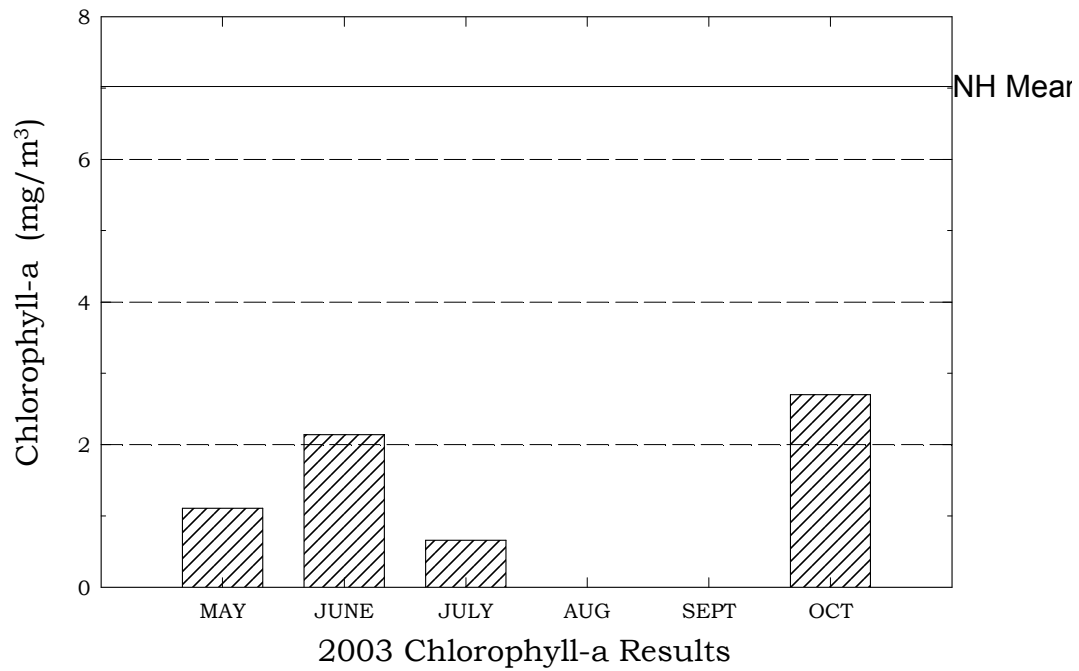
*Weed Watchers: An Association to Halt the Spread of Exotic Aquatic Plants*, WD-BB-4, NHDES Fact Sheet, (603) 271-3503 or [www.des.state.nh.us/factsheets/bb/bb-4.htm](http://www.des.state.nh.us/factsheets/bb/bb-4.htm).

# APPENDIX A

## GRAPHS

# Maxwell Pond, Manchester

**Figure 1.** Monthly and Historical Chlorophyll-a Results



## Maxwell Pond, Manchester

**Figure 2.** Monthly and Historical Transparency Results

